Innovation Adoption of Dairy Goat Farmers in Yogyakarta, Indonesia

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Abstract— *The objectives of this study were to analyze the structure, level of innovation adoption by dairy goat farmers and to analyze farmer characteristics which affected to adoption rate. The study was conducted in Sleman, Yogyakarta Province. The number of respondents were 162 dairy goat farmers, who were members of of farmer group in 6 groups. The structure adoption was analyze by descriptive while the relaionship between farmer characteristics and adoption rate was analyze by correlation and multiple linear regression. The results showed that farmers received innovation from the government, academic institution and other farmers. Farmers choose speech, group discussion and demonstration as the method of extension service and preferred to choose leaflets, film photograph, magazine and television as media for communication. The member of farmers group expected that innovation could improve their livestock productivity. The level of adoption was affected significantly by farmers experience and the number of goat ownership (P<0.01). the coefficient of determination of 0.176 indicated that 17.6% of variance was influenced by farmers experience and the number of goat ownership while 82% was affected by other factors.*

Keywords— adoption, innovation, farmer group, dairy goat farmer.

I. INTRODUCTION

The main focus in the field of animal husbandry in Indonesia is the production and productivity that are still low due to the nature of business which is still conventional. This condition is characterized by the management of the farm business is integrated farming system with crop and other agricultural activities, involving family members, small-scale livestock ownership, lack of knowledge and skills of farming became the causes of low production and productivity in livestock business in rural area. Agricultural innovation including animal husbandry as a successful introduction and exploitation of knowledge and technologies for social and economic benefits. The use of such knowledge and technologies brings about positive changes in how people make or do things, and ultimately improves their livelihoods (Spielman et al. 2009), Adoption of agricultural innovations is extremely important for the country agriculture and consequently for the development of the people in the rural areas (Aksoy et al., 2011). Farmers in general, used to adopt recommended practices in partial with wide technological gap especially in those complex practices in nature (Singha and Baruah, 2012).

The suply and demand of improved technologies involves a multi-faceted interaction among different actors both in public and private sector with each playing significant roles to stimulate and trigger nnovation development and adoption (Egyir et al, 2011). The acceptance of new technologies by farmers will contribute to the improvement of the economical profitability in shot term and the living condition of people in long term (Boz et al, 2002). With the recognition of the farmer as part of the process, it may serve as an incentive to promote adoption of any technology (Spielman, 2006). The adoption of agricultural technology depends on a range of personal, social, cultural and economic factors, as well as on the characteristics of the innovation itself (Pannell et al., 2006). The characteristics of the technology itself are also an important influence on farmers' technology adoption and usage decisions (Adesina and Zinnah, 1993). While the dissemination model is built on the diffusion theory by actively providing information about the innovation via change agents or intermediaries (Devine et al, 1987). Matuschke and Qaim (2009) opined that not all farmers at the village level will influence the adoption decision of a farmer on farm technology. Previous research undertaken by some researchers showed that education levels, capital, income, farm size, access to information, positive environmental attitudes, environmental awareness and utlilisation of social networks are generally positively, associated with the adoption of best management practices (Prokopy et al, 2008). In particular, the relative complexity, risk and investment characteristics of technologies (Batz et al, 1999). age, size of farm (in dairy cattle), education and size of operation (El-Osta and Morehart, 2002), the risk preferences of farmers (Sunding and Zilberman, 2001) and extension farmer ratio (Egyir et al, 2011). significantly affect their adoption and diffusion. Yet innovating smallholder farmers face systemic constraints to access markets, and need to organize in groups to exploit opportunities (Ayele et al, 2012).

Many studies concur that interaction with extension services (Millar, 2010; Garforth et al., 2003; Butcher, 1998) and peer-group behaviour (Sauer and Zilberman, 2010) also positively impact farmers' technology adoption decisions. It is clear from this brief review of the general technology adoption literature that many explanatory variables are considered important. Specifically in relation to breeding technologies, Khanal and Gillespie (2011) report that in the US dairy sector specialised, younger, more educated farmers are more likely to adopt advanced breeding technologies such as AI, sexed semen and embryo transplants. In the research of Aksoy et al (2011), studied in dairy farm, it was concluded that educational level of the farmers is an important problem to be overcome. The complexity of a scientific innovation is not a barrier to adoption if the communication pathway is appropriate and the message is tailored to the end user and can be understood and translated by intermediaries so that it fits with the practices of end users (Moreland and Hyland, 2013). In a study conducted by Turkyilmaz et al (2003) to determine the effects of socio-economical factors on the adoption of innovations in cattle farms in Aydin Province, it has been determined that the level of adoption in small and medium size farms was low in 25%, medium in 55% and high in 20% of the farms. On the other hand, in large size farms, while it was high in the other 50% of the farms.

Transformation of innovation has been carried out through extension activities undertaken by the government, private institutions (cooperative/non-cooperative) and academic. The transformation is expected to assist in improving productivity, but often there is a clear demarcation between the condition and the field study sites, between institutions channeling innovation (extension agents), and the recipient of the innovation group (farmers) who have diverse characteristics and limitations in accepting new innovations. This has resulted in low adoption of innovations that lead to low farm productivity. Therefore, the instructor needs to pay attention to the farmers' characteristics and situational characteristics that influence the decision of farmers to adopt innovations.

Most of the area of Sleman Regency has fertile agricultural land because it is around Mount Merapi and has a huge potential in the farm Ettawa crossbred goat (PE). Sleman Regency has farmer groups of Ettawa crossbred goat located in Turi district, which is Nganggring, Sukorejo, and Kemiri Kebo village, as well as in Minggir, Pakem, and Seyegan district. Farmer groups of Ettawa crossbred goat in Sleman have conducted coaching and management extension as well as the transfer of innovation from various parties, related agencies, and universities. But in the reality, the absorption and use of innovation is still limited. This is related to how the adoption of innovation that runs from the factors that influence the characteristics of farmers in adopting innovations.

Based on these descriptions, this research was expected to answer the following research questions: How much the level of innovation adoption of farmer groups of Ettawa crossbred goat in Sleman Regency, Yogyakarta Special Region province? And What are the farmers' characteristics that affect the rate of innovation adoption of farmer groups of Ettawa crossbred goat in Sleman, Yogyakarta Special Region province? Therefore**,** this study aims to determine the structure and level of the innovation adoption that was introduced to the members of the farmer groups of Ettawa crossbred goat, and to analyze the factors that influence to the adoption rate of the members in farmer groups of Ettawa crossbred goat in Sleman Regency, Yogyakarta.

II. MATERIAL AND METHOD

The research was conducted in Sleman Regency, Yogyakarta Province. Using the survey method, this research selected the number of respondents were 122 respondents who also became members of the group. In Turi district, the village is Nganggring, Sukorejo, and Kemiri Kebo, as well as the district of Minggir and Pakem. Innovations that have been introduced to the farmer groups of Ettawa crossbred goat in Sleman Rregency, Yogyakarta Province where: fresh forage, concentrate, food preservation, animal housing, medications and vitamins, recording livestock, animal mating method, as well as the handling of livestock by-product.

The method used in this research is a survey, which includes two phases: preparation and execution. The preparation phase is conducted to determine the location of the sample and farmers who will be the respondent and seek information about the condition of the famer groups. Site selection is conducted using purposive sampling method by selecting farmer groups of Ettawa crossbred goat in Sleman Regency, Yogyakarta. The number of samples is determined by using the slovin formula, with the following formula:

$$n = \frac{N}{1 + Ne^2}$$

Note:
n = Sample size
N = population size
e = Margin error earned

The number of farmer groups of Ettawa crossbred goat members is 161 people (n) with a margin of error (e) 5% obtained 114.8 samples. So this research required a minimum number of 115 respondents. Respondents were taken by using convenience sampling method to meet the number of respondents who have been determined. Required data derived from primary data and secondary data. Primary data were obtained by interviews using questionnaires or indirectly by using a questionnaire given to members of the farmer groups of Ettawa crossbred goat in Sleman regency.

The structure of innovation adoption was evaluated by using descriptive analysis in percent (%). The correlation between farmers' characteristics toward the level of innovation adoption of farmer of Ettawa crossbred goat was tested by using Product Moment Correlations. Correlation test followed linier correlation power between farmers' characteristics and the number of innovation adoption of Ettawa crossbred goat rising. The factor influencing innovation adoption was defined by using multiple regression linier analysis. It was used in following the formula as follows:

$$Y = a + b_1X_1 + b_2X_2 + b_3 X_3 + b_4X_4 + b_5X_5 + b_6X_6$$

Information

Y = number of adoption

a = intercept

X_1 = age (years)

X_2 = farming experience (years)

X_3 = education of farmer (years)

X_4 = number goat ownership (tail)

X_5 = number of family members (person)

X_6 = house – stall distance (meters)

b1, b2, b3, b4, b5, b6 = parameters to be expected (regression coefficient)

e = error rate

Adoption number is the ratio between the number of innovations adopted and the number of packets innovations introduced that was obtained by using the formula as follows:

$$\text{Adoption number} = X\ 100\% = \frac{\text{The number of innovation adopted}}{\text{The Number of innovation introduced}} \times 100\%$$

Correlation and regression data analysis performed in this research was using SPSS (Statistical Package for Social Science).

III. RESULTS AND DISCUSSION

3.1 Respondents' Characteristics

Respondents' characteristics in this research consisted of age, education, experience, number of family members, number of Ettawa crossbred goat owned, and house – stall distance.

3.1.1 Farmers' Age

The first respondents' characteristics that will be discussed are about age. Age of respondents was in the range of 21-70 years with an average of 44.93 ± 10.79 years. Productive age restrictions or working age for each country is in relation to economic development. Usually the population is of working age is the age group of 15 – 64 years. Age distribution of the respondents was listed in Table 1.

TABLE 1
DISTRIBUTION OF RESPONDENTS' AGE

	Number	Percentage (%)
Age (year)		
20 - 29	9	7.38
30 - 39	28	22.95
40 - 49	32	26.23
50 - 59	40	32.79
≥ 60	12	9.84
Total	122	100.00
Education		
Uneducated	7	5.74
Elementary	49	40.16
Junior High	21	17.21
Senior High	44	36.07
College	1	0.82
Total	122	100.00
Farming Experience (year)		
<1	8	6.56
1 – 10 year	62	50.82
11 – 20 year	47	38.52
> 20 year	5	4.10
Numbers of family (person)		
1 – 3 persons	72	59.02
4 – 6 persons	47	38.52
> 6 persons	3	2.46
	122	100.00
Number of Ettawa goat owned (Animal Unit)		
< 0.8	91	74.59
0.8 – 1.52	25	20.49
1.53 – 2.25	6	4.92
	122	100.00
House – stall distance (meter)		
< 100	12	9.84
100	48	39.34
400	37	30.33
700	23	18.85
>1000	2	1.64
	122	100.00

Most respondents were in the age range of 50-59 years. That age is still classified in the productive age. This age were relatively in a stable emotional condition so that they more receptive to guidance, and is supported by the presence of a strong enough impetus to gain experience at that age.

3.1.2 Education

The education level of respondents was mostly elementary for 49 people or by 40.16%. The education level of respondents is presented in Table 3. More than half were still less educated (elementary), because they did not follow the compulsory program of 9-year elementary education recommended by the government, or at least graduated from high school. The average age of respondents' education is equal to 8.22 ± 3.58 years, which means that the average education level of respondents still in elementary school. Education is very important for the progress of rural development. The higher the level of education of the population, the more developed also in the development of the village. Education is facilitating the development of agriculture because it can engage farmers to recognize the knowledge, skills and new ways of doing business. Education has an important role to the productivity of agriculture, including livestock.

3.1.3 Farming Ettawa Goat Experience

The results obtained from the primary data were a range of farming experience of respondents of 4 months – 27 years. Average farming experience of the respondents was 10.63 ± 7.28 years. It was presented in Table 4. Farmers' long experience in maintaining a livestock can affect the level of success in their efforts. The longer the experience, the more knowledge gained about the ins and outs of raising livestock. In general, the Ettawa crossbred goat farming businesses are static. Farmers gained their farming experience from the surrounding environment.

3.1.4 Number of Family Members

The number of family members ranged between 1 – 7 people, and the average family size was 3.30 ± 1.27 of people. The number of respondents' family members can affect the work that was done by the respondent families. The number of family members is presented in Table 5. The larger the number of family members of a person, then the responsibility concerned to meet the needs of family was increasing, so they need to be more active in seeking additional revenue. Usually, farmers involved their family members to participate in managing the farm business. Therefore, the more number of family members, the more workers will help farm business.

3.1.5 Total Ownership of Goats

The number of respondents' Ettawa crossbred goat ownership. It ranged between 6 – 7 animal units (AU). The average number of respondents' goat ownership is 0.63 ± 0, 41 AU. It means the number of respondents' goat ownership is still relatively small because the farmers are still conventional and purpose of breeding is still in the view that having Ettawa crossbred goat meant having a savings that may be sold in -time when money is needed immediately.

3.1.6 Stall – house Distance

The results showed that the average distance between the stall and the house was 424.92 ± 334.03 meters. The. Percentage of respondents' average distance between their stall and house was 100-300 m. Thus, the distance between the stall and the house was not too far away, so that the farmers can just walk or ride a motorcycle in the daily care routine for the cattle, especially for feeding.

3.2 Structure Innovation Adoption

3.2.1 Information Resources

Innovation transfer needed resources or communicators to deliver these innovations to the target. Sources of information in this research consisted of government, private sector, academia, and the farmers themselves. The results showed that farmers obtain a lot of information about innovation from the government (55.12%), academics (34.15%), private (0.00%), and farmers (10.73%). Information resources from the government came from government agencies, namely the Agency of Animal Husbandry and extension agents (PPL). Information resources of academia came from Universities Gadjah Mada (UGM). Farmers also got information about the innovation from the head of the group, members of the group and the other groups. They never get resources on innovation from the private sector. The results of research on the extension resources can be seen in Table 2.

TABLE 2
SOURCES OF INFORMATION ON LIVESTOCK EXTENSION

Innovation Source	Percentage
Government/Agency of Animal Husbandry	55.12
Private Sector	0.00
Academia	34.15
Other farmers	10.73

3.2.2 Extension method

Extension required methods and media to convey information about innovations to farmers. Extension methods are used to introduce the innovation that can be transfer through a lecture or speech, group meetings, and personal discussions with farmers. Here are the methods used to introduce the innovations presented in Table 3.

TABLE 3
THE METHOD USED TO INTRODUCE INNOVATIONS

Introduction Method	Percentage (%)
Speech	33.82
Farmers' meeting	32.84
Demonstration	33.33

Based on the results of primary data obtained, the method chosen by most of farmers to introduce new innovations was through the lecture method (33.82%), demonstration (33.33%) and group meetings (32.84%). Selection of the lecture method can provide an opportunity for farmers to ask questions and discuss the issues related to their farm. Lectures generally provide an opportunity for attendees to ask questions and discuss issues in-depth (Van den Ban Hawkins, 1999). Selection a method of demonstration was because farmers feel confident with the innovations offered when shown on means of true innovation and the innovation of the offer. The method of group meetings was conducted every month. The group meeting held a group counseling and social gathering, as a way to spread innovation among farmers themselves.

3.2.3 Extension Media

Here are the extension media options for the farmers. Percentage of the extension media chosen by the farmers were mostly choose to use leaflets. Farmers prefer to use a leaflet for the use of language that is easily understood, interesting presentation and directly express the point. Print media is effectively utilized by the target, so it needs to be presented in an easily understandable form that uses simple language, in the level the target ability to acquire and systematically presented (Van den Ban and Hawkins, 1996). Another extension media option were the film (23.94%), photos (19.72%), television (10.80%), agricultural magazines (7.98%), radio (6.57%), and newspapers (6.57%).

TABLE 4

Extension Media	Percentage (%)
Television	10.80
Radio	6.57
Newspaper	6.57
Agriculture Magazine	7.98
Leaflet	24.41
Photo	19.72
Film	23.94

EXTENSION MEDIA OPTION CHOSEN BY THE FARMERS

3.2.4 Farmers' Expectations

Farmers have several expectations in adopting innovations introduced. In table 5, it can be seen that they have several expectations that after applying these technologies, they will be able to increase livestock production (38.74%). Their expectations in applying other significant innovation were that innovation can increase farm income (25.30%), make the main farming business (12.65%), comply with the advice of the government (9.09%), save the cost of production (6.32%), employment (5.14%), and adjust the environment condition (2.77%).

TABLE 5
FARMERS' EXPECTATION IN APPLYING INNOVATION

Farmers' Expectations	Percentage (%)
Increasing livestock production	38.74
Saving production costs	6.32
Increasing farm income	25.30
Adjusting the environment condition	2.77
Complying the government's recommendation	9.09
Employment	5.14
Making the main farming business	12.65

3.3 Farmers' Adoption Levels

Farmers' adoption level can be measured from the types of innovations adopted by farmers as well as adoption numbers and calculations.

3.3.1 The Types of Innovations Adopted By the Farmers

Farming innovations introduced in Sleman regency were fresh forage, concentrate, food preservation, medicine and vitamins, cattle recording, artificial insemination, stall, and compost. These innovations have been adopted by some farmers who can be seen in Table 6.

TABLE 6
INNOVATIONS ADOPTED BY FARMERS

Types on Innovation	Number of farmers (person)	Percentage [a)] (%)
Fresh forage	122	100.00
Concentrate	106	86.89
Preservation of green forage	17	13.93
Medicine asnd vitamins	95	77.87
Recording	101	82.79
Artificial Insemination	0	0.00
Stage Stall	109	89.34
Compost	104	85.25

[a)] Calculated from the data on the number of respondents who adopt innovations divided by the total number of respondents multiplied by one hundred percent. Number of respondents = 122 farmers.

From the data obtained, it can be seen that all respondents using fresh forage (100%). This is reasonable because the area of Sleman regency is a mountain slope area and easy to find the source of water, so fresh forage such as *kaliandra* leaves, jackfruit leaves, *lamtoro* leaves, and *sengon* leaves were easily grown and obtained. Respondents who use the concentrate was 86.89%. This means that most of respondents use concentrates although the frequency and the amount were not regular. Irregular administration of the concentrate depends on the economic conditions of the respondents. Preservation innovation of forage was used by only a few farmers (13.93%). Various preservation used were silage, hay (dried forage), and fermented and ammoniated straw. Generally, those who use this method have a relatively large number of cattle. The use of forage preservation is to anticipate when the dry season arrives, because the fresh forage growth is relatively slower than usual. Drugs and vitamins used by only 77.87% of the total respondents. Various medicine and vitamins that used by breeders were worming, ointments scabies, lice drugs and drug fonts (diarrhea), iodine tincture and vitamin B complex. For the treatment of the cattle, the farmers were assisted by a paramedic located in the nearest of the groups' cattle stall. Recording was used by 82.79% of the total respondents. Various recording used by breeders were daily milk production recording, cattle health and body weight recording, and date of birth, as well as breeding registration. There was no respondents used Artificial Insemination (AI) (0%) as the breeding method for cattle because it may fail and also cost so high. Stage stall used by 89.34% of the respondents to facilitate cleaning the cage and took the goat manure to be used as fertilizer. A total of 104 respondents or 85.25% made compost. Composting was performed in the compost manufacture that had been provided in each farmer groups. Compost was made by mixing leaves from residual feed and goat manure by adding Em_4. Compost was greatly assist farmers in breaking up the soil because most of the members of the group were conducting farming.

3.3.2 Farmers' Adoption Number

Adoption level of the respondents ranged from 37.5% -87.5% (Appendix I) with an average (64.51 ± 9.67) %. The average rate of adoption of farmers can be seen in Table 7.

TABLE 7
AVERAGE RATE OF ADOPTION OF THE FARMER GROUPS OF ETTAWA CROSSBRED GOAT IN SLEMAN REGENCY

Farmer groups	Percentage (%)
Usaha Mandiri	70.83
Pangestu	73.12
Sukorejo I	61.61
Adijaya	57.64
Mandiri	73.86
Etawa Lestari	50
Average	64.51
Standard Deviation	9.67

Average adoption rate in farmer group of "Usaha Mandiri", "Pangestu", "Sukorejo", "Adijaya", "Mandiri" and "Etawa Lestari" was respectively 70.83%, 73.12%, 61, 61%, 57.64%, 73.86%, and 50% (Table 13). The highest adoption rates are in farmer group of "Mandiri" and the lowest are in the farmer group of "Etawa Lestari". It is proved that in farmer group of "Mandiri", respondents who use of Ettawa crossbred goat farming innovation were larger than those who were in the farmer group of "Pangestu", "Usaha Mandiiri", "Sukorejo I", "Adijaya", and "Ettawa Lestari". Criteria for adoption rate can be classified high (50-100%) and low (10-40%). Most of the respondents in the amount of 64.51% were already implementing innovations introduced such as fresh forage, concentrates, forage preservation, medicine and vitamins, recording, artificial insemination, stage stall, as well as compost, although not all respondents apply.

3.4 Factors that Influence the Innovation Adoption Numbers

This research used the factors that are used as independent variables: age, education, farming experience, number of family member, number of goat ownership, and house – stall distance. All of these variables were considered how big its influence towards innovation adoption rate (the first dependent variable). Regression analysis method was used to find some of the great influence of the independent variables towards the dependent variable. Multiple linear regressions were used as this research used more than one independent variable. One of the requirements in the regression analysis is that it must be determined first whether the independent variables and the dependent variables are related (correlation) or not. It was determined by using Pearson's Product Moment.

The results of correlation analysis showed that the experience of raising goats and total ownership has a significant correlation ($P < 0.01$) with the number of adoption, with a correlation coefficient of 0.392 ($P<0.01$) and 0.454 ($P<0.01$). The correlation coefficient showed a weak correlation between total ownership and farming experience of goats since it was under 0.5. The correlation coefficient was positive, which indicates that the farmer, who had experience in raising goats as well as a high number of ownership, will adopt in a high number.

House – stall distance also had a significant correlation ($P < 0.05$) with the number of adoption, with a correlation coefficient of 0.204 ($P<0.05$). The correlation coefficient indicates the weak correlation ($r < 0.5$) between the house – stall distance with adoption rate. House – stall distance away will make high adoption rate.

Age and education were not significantly correlated with adoption rate ($P > 0.05$) with a correlation coefficient of -0.076 and 0.022. The correlation coefficients showed that age was weakly correlated with the adoption rate, and showed negative correlation that means high age will make a small number of adoption. Education also has a weak correlation with adoption numbers and showed that higher education will create a high number of adoption. The number of family members was not significantly correlated with the adoption numbers ($P > 0.05$) with a correlation coefficient of -0.091. In contrast with study of Khanal and Gillespie (2011); Prokopy et al (2006); and Aksoy et al (2011), they concluded that eductional level of the farmers is an important problem to be solve in adoption process.

The correlation coefficient indicates that the number of family members was weakly correlated with adoption numbers, and showed negative correlation which means that the large number of family will causing low adoption number. The result of correlation analysis between variables and the adoption rate was analyzed by using Pearson's Product Moment Correlation.

TABLE 8
RESULTS OF THE ANALYSIS OF THE CORRELATION BETWEEN VARIABLES AND THE ADOPTION RATE BY USING PEARSON'S PRODUCT MOMENT CORRELATION

Variables	Coefficient Correlation	P
Age	-0.076	0.404
Farming experience	0.392 (**)	0.000
Education level	0.022	0.806
Number of goat ownership	0.454 (**)	0.000
Number of family member	-0.091	0.320
House – stall distance	0.204 (*)	0.024

Remark : ** significant at P <0.01
*** significant at P < 0.05**

The results of the data analysis showed the variables that have a significant correlation with the adoption of innovations were farming experience, the number of goat ownership, and house – stall distance. These variables then further analyzed by using multiple linear regression analysis. This analysis aimed at determining the influence of these variables on innovation adoption. The results of multiple linear regression analysis between the variables of age, education and number of goats ownership and adoption rate by using the enter method is shown in Table 9.

TABLE 9
RESULTS OF MULTIPLE LINEAR REGRESSION ANALYSIS BETWEEN THE VARIABLES OF AGE, EDUCATION AND NUMBER OF GOATS OWNERSHIP AND ADOPTION RATE BY USING THE ENTER METHOD.

Model		Regression Coeficient	Sig
I	(constant)	4.195	0.000
	Farming experience	0.043	0.001 **
	Number of goat ownership	1.037	0.000**
	House – stall distance	0.000	0.275
Adjusted R2		0.279	
F		16.596	0.000**

Remark : ** significant at P <0.01
*** significant at P < 0.05**

After multiple linear regressions analysis was performed on farming experience variable, the number of goats ownership, and house – stall distance, it showed that partially, house – stall distance did not have an influence on the innovation adoption. House – stall distance did not affect the innovation adoption. Experience had a significant influence on innovation (P <0.05) (Table 9). The longer the respondents' experience means the higher the number the innovation adoption. Farmers who have experienced will be more aware of the risks to be faced when trying something new, so they will be faster in adopting innovations. With longer experience, it will make someone mentally be resilient and flexible to the situation, so they did not be surprised by anything changes that will affect the farm business. Rigid-minded farmers will try with the conventional formulation of hard work, perseverance, and efficient in the farm management, but it is difficult to carry out innovation adoption. This is consistent with previous evidence Baffoe-Asare et al (2013) in Ghana and Namwata et al (2010) in Tanzania documented that farmers who had lots of experience in terms of years of growing tree crop had enhanced skills and therefore will be able to make critical decisions regarding adoption.

The number of cattle ownership has a significant influence on the number of innovation adoption (P <0.01) (Table 9). It means that the more the number of cattle owned by the respondent, the higher the number the innovation adoption. Traditional farmers usually have only a small livestock farming business and the income is also small, so that the innovation adoption is relatively slow because they will prioritize the needs of the family. On the other hand, farmers who have a relatively large number of goats usually have higher levels of farm income and their family needs are fulfilled, so the willingness to experiment or change in adoption of agricultural innovations was relatively fast, in accordance with the their agriculture conditions. Innovations adoption that was used will lead to higher incomes of farmers. Thus, farmers will invest their capital again for further innovation adoption. The reality showed that low-income farmers were slow in adopting innovations. This finding is supported by Asfaw et al (2011), they reported a positive relationship between livestock

ownership and the adoption decision amongst pigeon pea farmers in Ethiopia. They argued that being constained credit limitations, small scale farmers tend to adopt more when this constraint is eliminated.

The number of Adjusted R Square 0.279 (Table 9) means that 27.9% of the variance and innovation adoption was influenced by farming experience, the number of cattle owned, and house – stall distance, while 72.1% is explained by other causes that cannot be explained in this research. All variables analyzed together had an influence on innovation adoption numbers (P <0.01). Therefore, the regression model can be used to predict the innovation adoption. The multiple linear regression equation of enter method obtained is:

$$Y = 4.195 + 0.043X_2 + 1.037X_4 + 0.00X_6$$

Information:

Y	=	Adoption number
X_2	=	Farming experience (years)
X_4	=	Number of cattle ownership (head)
X_6	=	house – stall distance (meter)

To remove the significant independent variables that were not, regression analysis was conducted with stepwise method. The results obtained and the Model 1 stepwise analysis is that the number of cattle ownership had the strongest influence on the adoption numbers with regression coefficient of 1.254 (P <0.01) and the determination coefficient (adjusted R2) of 0.200. In model 2, it showed that the variables of the experience of raising goats was included in the variables influencing the adoption number with regression coefficient of 0.046 (P <0.01), and the value of the determination coefficient (adjusted R^2) of 0.278. Regression coefficient number of livestock ownership in Model 2, decreased 1.051. The results of multiple linear regression analysis between farming experience, the number of cattle ownership, and house – stall distance with adoption rate using the stepwise method can be shown in Table 10.

TABLE 10

RESULTS OF MULTIPLE LINEAR REGRESSION ANALYSIS BETWEEN FARMING EXPERIENCE, THE NUMBER OF CATTLE OWNERSHIP, AND HOUSE – STALL DISTANCE WITH ADOPTION RATE USING THE STEPWISE METHOD

Model		Regression coefficient B	Sig
1	(Constant)	4.639	0.000**
	Number of goat ownership	1.254	0.000**
	Adjusted R2 = 0.200		
	F = 31.210		0.000**
2	(Constant)	4.273	0.000**
	Number of goat ownership	1.051	0.000**
	Farming experience	0.46	0.000**
	Adjusted R2 = 0.278		
	F = 24.250		0.000**

Information : ** significant at P< 0.01
*** significant at P <0.05**

The results of the analysis indicated that the variable of house – stall distance did not strongly influence the adoption numbers, so that the age variable was not included in the stepwise analysis model. Farming experience, and number of goats ownership jointly influenced the rate of innovations adoption of (P <0.01). Coefficient of determination is 0.278. The results of multiple linear regression analysis between variables of farming experience, the amount of goat ownership, and house – stall distance with adoption rate by using the stepwise method can be seen in Table 10. This means that 27.8% of variance and technology adoption was affected by the variance, the number of goats ownership, and farming experience, while 72.2% was explained by other causes that cannot be explained in this research. All variables analyzed together had an influence on innovation adoption numbers (P <0.01), the regression model can be used to predict the innovation adoption. The regression equation obtained was

$$Y = 4.273 + 1.051 + 0.46\ X2\ X4.$$

Information

V = Adoption number
X_2 = Farming experience (years
X_4 = Number of goat ownership (head)

IV. CONCLUSION

The results of this research concluded that there were many innovations used by farmers in accordance with the innovation recommended by the extension agents. Factors that influence the number of the innovation adoption were farming experience, and number of goat ownership. The longer the farming experience, the greater the number of adoption. The more goats one has, the greater number of innovation adoption. In conducting extension, the extension agents should take into account the experience of raising goats and the number of goats owned, because based on the research results, it can be stated that farmers who have experience and a large number of goats ownership, have higher adoption number also.

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REFERENCES

[1] Adesina, A., & Zinnah, M. M. (1993). Technology characteristics, farmers' perceptions and adoption decisions: A Tobit model application in Sierra Leone, *Agricultural Economics*, *9*, 297-311.

[2] Aksoy A, M. Kulekci and F Yavuz. 2011. Analysis of the factors affecting the adoption of innovations in dairy farms in Erzurum Province, Turkey. African Journal of Agricultural Research. 6(13):2966-2970.

[3] Asfaw S, B Shiferaw, F Simtowe, and M Hagos. 2011. Agricultural technology adoption, seed access constrains and commercialization in Ethiopia. J. Develop Agric Econ. 3(9):436-447.

[4] Ayele S, A Duncan, A Larbi and TT Khanh. 2012. Enhancing innovation in livestock value chains through networks: Lessons from fodder innovation case studies in developing countries. Science and Public Policy, 39:333–346.

[5] Baffoe-Asare R, JA Danquah and F Annor-Frempong. 2013. Socioeconomic factors influencing adoption of CODAPEC and cocoa high-tech I technologies among smallholder farmers in Central Region of Ghana 2. American Jhournal of Experimental Agriculture. 3(2):277-292.

[6] Batz, F. J., Peters, K. J., & Janssen, W. (1999). The influence of technology characteristics on the rate and speed of adoption, *Agricultural Economics, 21*, 121 -130.

[7] Boz I, C Akbay, and E Orhan. 2002. The factors adoption and diffusion of corn production in Kahramanmaras Turkey. The V.Congress of Agricultural Economics (18-20 September), Erzurum: 440-448.

[8] Butcher, S. (1998). Where do farmers get their information? *Primary Industry Management, 1*, 2, 12-15.

[9] Dairy Farms, *Southern Agricultural Economics Association Annual Meeting*, Corpus Christi, TX, February 5-8:2011

[10] Devine MD, TE James, and TI Adams. 1987. Government supported industry-university research centers: Issues for successful technology transfer. Journal of Technology Transfer 12(1):27-37.

[11] Egyir IS, E Owusu-Benoah, FO Anno-Nyako, and B Banful. 2011. Assessing the factors of adoption of agrochemicals by plantain farmers in Ghana. Journal of Enterprising Communities. 5(1):83-97.

[12] El-Osta, H. S., & Morehart, M. J. (2002). Technology Adoption and Its Impact on Production Performance of Dairy Operations, *Review of Agricultural Economics*, *22*, 2, 477–498.

[13] Garforth, C., Angell, B., Archer, J., & Green, K., (2003). Fragmentation or creative diversity? Options in the provision of land management advisory services, *Land Use Policy*, *20*, 323-333.

[14] Khanal, A. R., & Gillespie, J. M. (2011). Adoption and Profitability of Breeding Technologies on United States

[15] Matuschke I, M Qaim, 2009. The impact of social networks on hybrid seed adoption in India. Agricultural Economics. 40(5):493-505.

[16] Millar, J. (2010). The Role of Extension for Improving Natural Resource Management: the Australian Experience in Jennings J., Packham R., Woodside D. (Eds.) *Shaping Change: Natural Resource Management, Agriculture and the Role of Extension*. Australasia-Pacific Extension Network (APEN), Australia, 102-110.

[17] Moreland H and P Hyland. 2013. Improving communication and increasing adption of innovations in the beef industry. Journal of Science Communication (JCOM) 12(2):1-17.

[18] Namwata BML, JL Welamira, and OB Mzirai. 2010. Adoption of improved agricultural technologies for Irish potatoes (*Solanum tuberosum*) among farmers in Mbeya rural district, Tanzania: a case of Ilungu ward. J. Anim.Plant Science. 8(1):927-935.

[19] Pannell, D. J., Marshall, G. R., Barr, N., Curtis, A., Vanclay, F., & Wilkinson, R. (2006). Understanding and promoting adoption of conservation practices by rural landholders. *Australian Journal of Experimental Agriculture*, *46*, 1407-1424.

[20] Prokopy, L. S., Floress, K., Klotthor-Weinkauf, & Baumgart-Getz. (2008). Determinants of agricultural best management practice adoption: Evidence from the literature. *Journal of Soil and Water Conservation*, *63*(5):300-311.

[21] Sauer, J., & Zilberman, D. (2010). Innovation Behaviour at Farm Level – Selection and Identification, *114th EAAE Seminar 'Structural Change in Agriculture'*, Berlin, Germany, April 15th – 16th, 2010.

[22] Singha AK and MJ Baruah. 2012. Adoption behavior of dairy innovations by small farmers under different farming systems in Assam. Indian Res J. Ext.Edu. 12(3):60-64.

[23] Spielman DJ, 2006. A critique of innovation systems perspectives on agricultural research in developing countries. Innovation Strategy Today. 2(1):25-38.

[24] Spielman, D., Ekboir, J. & Davis, K. (2009) 'The art and science of innovation systems inquiry: applications to Sub-Saharan African agriculture', Technology in Society, 31: 399–405.

[25] Sunding, D., & Zilberman, D. (2001). The Agricultural Innovation Process: Research and Technology Adoption in a Changing Agricultural Sector, in Gardner B and Rausser G (eds) *Handbook of Agricultural Economics*, Vol.1, Elsevier Science B.V.

[26] Turkyilmaz MK, HE Bardakcioglu, and A. Nazligul 2003. Socio-economic factors effective for the adoption of innovations at the dairy farms at the province of Aydin, Turk. J.Vet. Anim.Sci. 27(6):1269-1275.